CLAIMS

1. A gas separation membrane for separating hydrogen from a gas stream, the gas separation membrane comprising:

a transmission member including a porous body of metal particles compacted and bonded together and a chemisorption-dissociation-diffusion coating;

the porous body having a first surface and a second surface opposite one another, the porosity of the porous body increasing from the first surface to the second surface, the metal particles including a quantity of at least one of metal fibers and metal powder;

the chemisorption-dissociation-diffusion coating being disposed on the first surface; and

the gas separation membrane being structured to receive the gas stream against one of the chemisorption-dissociation-diffusion coating and the second surface and permeate a quantity of hydrogen through the gas separation membrane and out of the other of the chemisorption-dissociation-diffusion coating and the second surface, the chemisorption-dissociation-diffusion coating being structured to permit chemisorption-dissociation-diffusion of hydrogen therethrough.

2. The gas separation membrane as set forth in Claim 1, in which the increase in porosity from the first surface to the second surface is due to an increase in the size of the metal particles from the first surface to the second surface.

3. The gas separation membrane as set forth in Claim 1, in which the increase in porosity from the first surface to the second surface is due to a decrease in the degree of compaction of the metal particles from the first surface to the second surface.

4. The gas separation membrane as set forth in Claim 1, in which the chemisorption-dissociation-diffusion coating is a metal coating.

5. The gas separation membrane as set forth in Claim 4, in which the porous body further includes a layer of ceramic particles interposed between the metal particles and the metal coating.

6. The gas separation membrane as set forth in Claim 1, in which the transmission member includes a catalytic enhancement structured to increase the concentration of hydrogen in the gas stream.

7. The gas separation membrane as set forth in Claim 6, in which the catalytic enhancement includes a plurality of particles of catalytic material combined with the metal particles of the porous body.

8. The gas separation membrane as set forth in Claim 6, in which the catalytic enhancement includes a layer of catalytic material disposed on the porous body opposite the chemisorption-dissociation-diffusion coating.

9. The gas separation membrane as set forth in Claim 8, in which the transmission member includes a ceramic-based washcoat opposite the chemisorption-dissociation-diffusion coating, the layer of catalytic material being disposed on the washcoat.

10. The gas separation membrane as set forth in Claim 8, in which the catalytic enhancement includes a plurality of particles of catalytic material disposed on the porous body, the particles of catalytic material include particles of at least one of perovskite, zeolite, and spinel.

11. The gas separation membrane as set forth in Claim 6, in which the catalytic enhancement includes a coating of catalytic material disposed on the outer surface of at least one of the metal particles of the porous body.

12. The gas separation membrane as set forth in Claim 6, in which the catalytic enhancement includes one of platinum, palladium, and rhodium.

13. The gas separation membrane as set forth in Claim 1, further comprising a support structure, the transmission member being mounted on the support structure.

14. The gas separation membrane as set forth in Claim 13, in which the support structure includes at least one of a metal mesh and a perforated metal plate.

15. The gas separation membrane as set forth in Claim 14, in which the transmission member is disposed adjacent the support structure.

16. The gas separation membrane as set forth in Claim 14, in which the support structure extends through the transmission member.

17. A gas separation membrane for separating hydrogen from a gas stream, the gas separation membrane comprising:

a transmission member including a porous body and a catalytic enhancement, the transmission member having a first surface and an opposite second surface;

the porous body including a plurality of metal particles compacted and bonded together, the metal particles including a quantity of at least one of metal fibers and metal powder;

the catalytic enhancement being structured to increase the concentration of hydrogen in the gas stream; and

the gas separation membrane being structured to receive the gas stream against one of the first and second surfaces and permeate a quantity of hydrogen through the gas separation membrane and out of the other of the first and second surfaces.

18. The gas separation membrane as set forth in Claim 17, in which the catalytic enhancement includes a plurality of particles of catalytic material combined with the metal particles of the porous body.

19. The gas separation membrane as set forth in Claim 17, in which the catalytic enhancement includes a layer of catalytic material on the porous body.

20. The gas separation membrane as set forth in Claim 19, in which the transmission member includes a ceramic-based washcoat on the porous body, the layer of catalytic material being disposed on the washcoat.

21. The gas separation membrane as set forth in Claim 19, in which the layer of catalytic material includes a plurality of particles of catalytic material disposed on the porous body, the particles of catalytic material including particles of at least one of perovskite, zeolite, and spinel.

22. The gas separation membrane as set forth in Claim 17, in which the catalytic enhancement includes a coating of catalytic material disposed on the outer surface of at least one of the metal particles of the porous body.

23. The gas separation membrane as set forth in Claim 17, in which the porosity of the transmission member increases from the first surface to the second surface.

24. The gas separation membrane as set forth in Claim 23, in which the increase in porosity from the first surface to the second surface is due to an increase in the size of the metal particles from the first surface to the second surface.

25. The gas separation membrane as set forth in Claim 23, in which the increase in porosity from the first surface to the second surface is due to a decrease in the degree of compaction of the metal particles from the first surface to the second surface.

26. The gas separation membrane as set forth in Claim 25, in which the transmission member further includes a layer of ceramic particles disposed on the porous body.

27. The gas separation membrane as set forth in Claim 17, further comprising a support structure, the transmission member being mounted on the support structure.

28. The gas separation membrane as set forth in Claim 27, in which the support structure includes at least one of a metal mesh and a perforated metal plate.

29. The gas separation membrane as set forth in Claim 28, in which the transmission member is disposed adjacent the support structure.

30. The gas separation membrane as set forth in Claim 28, in which the support structure extends through the transmission member.

31. The gas separation membrane as set forth in Claim 17, in which the catalytic enhancement includes one of platinum, palladium, and rhodium.

32. A method of separating hydrogen gas from a gas stream, said method comprising the steps of:

flowing the gas stream into contact with a first surface of a transmission member, the transmission member including a porous body of metal particles compacted and bonded together;

interacting the gas stream with a catalytic enhancement incorporated into the transmission member; and

exhausting hydrogen gas out of an opposite second surface of the transmission member.

33. The method as set forth in Claim 32, in which the step of interacting the gas stream with a catalytic enhancement includes the step of performing a water gas shift reaction on the gas stream with the catalytic enhancement.

34. The method as set forth in Claim 32, in which the step of interacting the gas stream with a catalytic enhancement includes the step of performing an ammonia decomposition reaction on the gas stream with the catalytic enhancement.

35. The method as set forth in Claim 32, in which the step of interacting the gas stream with a catalytic enhancement includes the step of contacting the gas stream with a quantity of particles of catalytic material within the porous body.

36. The method as set forth in Claim 32, in which the step of interacting the gas stream with a catalytic enhancement includes the step of contacting the gas stream with a layer of catalytic material disposed on the transmission member.